



COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY
DRAFT PERMIT

TO WITHDRAW GROUNDWATER IN THE
EASTERN VIRGINIA GROUNDWATER MANAGEMENT AREA

Permit Number: GW0022600

Effective Date: XXXXXXXX XX, XX23

Expiration Date: XXXXXXXX XX, XX38

Pursuant to the Ground Water Management Act of 1992 (Section 62.1-254 et seq. of the Code of Virginia) and the Groundwater Withdrawal Regulations (Regulations) (9VAC25-610), the Department of Environmental Quality hereby authorizes the Permittee to withdraw and use groundwater in accordance with this permit.

Permittee Riverside Healthcare Association, Inc.

Facility Patriots Colony at Williamsburg

Facility Address 6000 Patriots Colony Drive

Williamsburg, VA 23188

The Permittee's authorized groundwater withdrawal shall not exceed:

7,500,000 gallons per year,
2,700,000 gallons per month,

The permitted withdrawal will be used to provide irrigation water for a retirement community. Other uses are not authorized by this permit.

The Permittee shall comply with all conditions and requirements of the permit.

By direction of the Department of Environmental Quality, this Permit is granted by:

Signed _____

Scott Morris, DBA, P.E.
Director, Water Division

Date _____

This permit is based on the Permittee's application submitted on May 15, 2019, and subsequently amended to include supplemental information provided by the Permittee. The following are conditions that govern the system set-up and operation, monitoring, reporting, and recordkeeping pertinent to the Regulations.

Part I Operating Conditions

A. Authorized Withdrawal

1. The withdrawal of groundwater shall be limited to the following wells identified in the table below. Withdrawals from wells not included in Table 1 are not authorized by this permit and are therefore prohibited. 9VAC25-610-140 A

Table 1

Owner Well Name	DEQ Well #	Well Depth (ft bls)	Screen Intervals	Aquifer	Latitude	Longitude	Datum
Well at Villa 3 (Well #3)	147-00345	420	397-416	Potomac	37° 15' 23.324"	-76° 48' 36.727"	NAD83
Green Springs Well (Well #4)	147-00346	429	386-396, 417-427	Potomac	37° 15' 31.279"	-76° 48' 40.274"	NAD83
Well at Villa 8 (Well #5)	147-00347	467	421-467	Potomac	37° 15' 15.669"	-76° 48' 31.767"	NAD83
Resident Wood Shop Well (Well #6)	147-00348	445	425-445	Potomac	37° 15' 25.937"	-76° 48' 23.630"	NAD83

2. Any actions that result in a change to the status, construction, or pump intake setting of wells included in this permit must be pre-approved by the Department of Environmental Quality (Department or DEQ) in writing prior to implementing the change and a revised GW-2 Form must be submitted to the Department within 30 days after the physical construction of a well is altered or the pump intake setting has been changed. If changes are a result of an emergency, notify the Department within 5 days from the change. 9VAC25-610-140 C

B. Pump Intake Settings

1. The Permittee shall not place a pump or water intake device lower than the top of the uppermost confined aquifer that a well utilizes as a groundwater source or lower than the bottom of an unconfined aquifer that a well utilizes as a groundwater source in order to prevent dewatering of the aquifer, loss of inelastic storage, or damage to the aquifer from compaction. 9VAC25-610-140 A 6
2. Pump settings in individual wells are limited as follows. Any change in the pump setting must receive prior approval by the Department.

Owner Well Name	DEQ Well #	Max Pump Setting (feet below land surface)
Well at Villa 3 (Well #3)	147-00345	300
Green Springs Well (Well #4)	147-00346	300
Well at Villa 8 (Well #5)	147-00347	303
Resident Wood Shop Well (Well #6)	147-00348	303

C. Reporting

1. Water withdrawn from each shall be recorded monthly at the end of each month and reported to the Department, in paper or electronic format, on a form provided by the Department by the tenth (10th) day of each January, April, July and October for the respective previous calendar quarter. Records of water use shall be maintained by the Permittee in accordance with Part III.F, 1 through 5 of this permit. 9VAC25-610-140 A 9
2. The Permittee shall report any amount in excess of the permitted withdrawal limit by the fifth (5th) day of the month following the month when such a withdrawal occurred. Failure to report may result in compliance or enforcement activities. 9VAC25-610-140 C
3. The following is a summary of reporting requirements for specific facility wells:

Owner Well Name	DEQ Well #	Reporting Requirements
Well at Villa 3 (Well #3)	147-00345	Water Use
Green Springs Well (Well #4)	147-00346	Water Use
Well at Villa 8 (Well #5)	147-00347	Water Use
Resident Wood Shop Well (Well #6)	147-00348	Water Use

D. Water Conservation and Management Plan

1. The Water Conservation and Management Plan (WCMP) submitted in the application received [date] and subsequently amended and then approved by the Department is incorporated by reference into this permit and shall have the same effect as any condition contained in this permit and may be enforced as such.
2. By the end of the first year of the permit cycle [date] the Permittee shall submit documentation to the Department that the leak detection and repair program defined in the WCMP has been initiated. This documentation shall include activities completed during the first year of the permit term. 9VAC25-610-100 B
3. As soon as completed but not later than the end of the second year of the permit cycle [date] the Permittee shall submit to the Department results of an audit of the total amount of groundwater used in the distribution system and operational processes. This documentation shall include any resulting changes to the leak detection and repair program in the WCMP. 9VAC25-610-100 B
4. A report on the plan's effectiveness in reducing water use, including revisions to those elements of the WCMP that can be improved and addition of other elements found to be effective based on operations to date shall be submitted by the end of years five [date] and ten [date] of the permit term. These reports shall include as appropriate: 9VAC25-610-140 C
 - a. Any new water saving equipment installed or water saving processes adopted;
 - b. WCMP actions taken to reduce the volume of water needed to supply the system;
 - c. Planned short or long term efforts and actions to be added to the WCMP to improve the efficiency of water use in the system or by customers and for reducing the loss of water;

- d. Results of additional water audits completed;
 - e. Review of water use category (residential, commercial, industrial) per-connection use in municipal systems;
 - f. Evaluation of the leak detection and repair program;
 - g. Description of educational activities completed; and
 - h. Identification of any water reuse opportunities identified.
5. If revisions or additions to the plan are necessary, an updated WCMP shall be submitted to the Department for approval along with the report prior to implementation of the revised plan.
 6. Records of activities conducted pursuant to the WCMP are to be submitted to the Department upon request.

E. Well Tags

1. Each well that is included in this permit shall have affixed to the well casing, in a prominent place, a permanent well identification plate that records, at a minimum, the Department well identification number, the groundwater withdrawal permit number, the total depth of the well, and the screened intervals in the well. Such well identification plates shall be in a format specified by the Department and are available from the Department. 9VAC25-610-140 A 12
2. Well tags shall be affixed to the appropriate well casing within 30 days of receiving the tags from the Department. The accompanying well tag installation certification form shall be returned to the Department within 60 days of receipt of the tags. 9VAC25-610-140 C

Part II Special Conditions

Pursuant to 9VAC25-610-140 B and C, the following Special Conditions apply to this permit in order to protect the public welfare, safety, and health or conserve, protect and help ensure the beneficial use of groundwater.

A. Pump Intake Reset

Within one year, the Permittee shall ensure the pump intake for the Green Springs Well (Well #4) (DEQ Well #147-00346) is at or above the stated maximum pump setting as provided in feet below land surface (ft. bls). The Permittee shall advise the Department, in writing, of the new pump setting within 30 days of the modification.

B. Well Abandonment

Well One (DEQ #147-00343) and Well Two (DEQ#147-0344) were presumed to be abandoned or capped but no documentation was located to clarify the status. Therefore, the status of the well will need to be verified and if found to be not abandoned, abandonment according to VDH regulations will be necessary. The permit requires verification and if necessary, abandonment 270 days before reapplication.

Part III General Conditions

A. Duty to Comply

The Permittee shall comply with all conditions of the permit. Nothing in this permit shall be construed to relieve the permit holder of the duty to comply with all applicable federal and state statutes, regulations and prohibitions. Any permit violation is a violation of the law and is grounds for enforcement action, permit termination, revocation, modification, or denial of a permit application. 9VAC25-610-130 A

B. Duty to Cease or Confine Activity

It shall not be a defense for a Permittee in an enforcement action that it would have been necessary to halt or reduce the activity for which a permit has been granted in order to maintain compliance with the conditions of the permit. 9VAC25-610-130 B

C. Duty to Mitigate

The Permittee shall take all reasonable steps to avoid all adverse impacts that may result from this withdrawal as defined in 9VAC25-610-10 and provide mitigation of the adverse impact when necessary as described in 9VAC25-610-110 D 3 g and 9VAC25-610-130 C.

D. Inspection, Entry, and Information Requests

Upon presentation of credentials, the Permittee shall allow the Department, or any duly authorized agent of the Department, at reasonable times and under reasonable circumstances, to enter upon the Permittee's property, public or private, and have access to, inspect and copy any records that must be kept as part of the permit conditions, and to inspect any facilities, well(s), water supply system, operations, or practices (including sampling, monitoring and withdrawal) regulated or required under the permit. For the purpose of this section, the time for inspection shall be deemed reasonable during regular business hours. Nothing contained herein shall make an inspection time unreasonable during an emergency. 9VAC25-610-130 D

E. Duty to Provide Information

The Permittee shall furnish to the Department, within a reasonable time, any information that the Department may request to determine whether cause exists for modifying or revoking, reissuing, or terminating the permit, or to determine compliance with the permit. The Permittee shall also furnish to

the Department, upon request, copies of records required to be kept by regulation or this permit.
9VAC25-610-130 E

F. Monitoring and Records Requirements

1. The Permittee shall maintain a copy of the permit on-site and/or shall make the permit available upon request. 9VAC25-610-130 E
2. Monitoring of parameters shall be conducted according to approved analytical methods as specified in the permit. 9VAC25-610-130 F 1
3. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. 9VAC25-610-130 F 2
4. The Permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart or electronic recordings for continuous monitoring instrumentation, copies of all reports required by the permit, and records of all data used to complete the application for the permit, for a period of at least three years from the date of the expiration of a granted permit. This period may be extended by request of the Department at any time. 9VAC25-610-130 F 3
5. Records of monitoring information shall include as appropriate: 9VAC25-610-130 F 4
 - a. the date, exact place and time of sampling or measurements;
 - b. the name(s) of the individual(s) who performed the sampling or measurements;
 - c. the date the analyses were performed;
 - d. the name(s) of the individual(s) who performed the analyses;
 - e. the analytical techniques or methods supporting the information, such as observations, readings, calculations and bench data used;
 - f. the results of such analyses; and
 - g. chain of custody documentation.

G. Environmental Laboratory Certification

The Permittee shall comply with the requirement for certification of laboratories conducting any tests, analyses, measurements, or monitoring required pursuant to the State Water Control Law (§ 62.1-44.2 et seq. of the Code of Virginia), Environmental Laboratory Certification Program (§ 2.2-1105 et seq. of the Code of Virginia), Certification for Noncommercial Environmental Laboratories (1VAC30-45), and/or Accreditation for Commercial Environmental Laboratories (1VAC30-46), and

1. Ensure that all samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

2. Conduct monitoring according to procedures approved under 40CFR Part 136 or alternative methods approved by the U.S. Environmental Protection Agency.
3. Periodically calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals that will ensure accuracy of measurements. 1VAC30-45-20

H. Future Permitting Actions

1. A permit may be modified or revoked as set forth in Part VI of the Groundwater Withdrawal Regulations. 9VAC25-610-290 and 9VAC25-610-130 G
2. If a Permittee files a request for permit modification or revocation, or files a notification of planned changes, or anticipated noncompliance, the permit terms and conditions shall remain effective until the Department makes a final case decision. This provision shall not be used to extend the expiration date of the effective permit. 9VAC25-610-130 G
3. Permits may be modified or revoked upon the request of the Permittee, or upon Department initiative, to reflect the requirements of any changes in the statutes or regulations. 9VAC25-610-130 G
4. The Permittee shall schedule a meeting with the Department prior to submitting a new, expanded or modified permit application. 9VAC25-610-85
5. A new permit application shall be submitted 270 days prior to the expiration date of this permit, unless permission for a later date has been granted by the Department, to continue a withdrawal greater than or equal to 300,000 gallons in any month while an application for a renewal is being processed. 9VAC25-610-96
6. A new permit application shall be submitted 270 days prior to any proposed modification to this permit that will (i) result in an increase of withdrawal above permitted limits; or (ii) violate the terms and conditions of this permit. 9VAC25-610-96
7. The applicant shall provide all information described in 9VAC25-610-94 for any reapplication. 9VAC25-610-96 C
8. The Permittee must notify the Department in writing of any changes to owner and facility contact information within 30 days of the change. 9VAC25-610-140 C

I. Metering and Equipment Requirements

1. Each well and/or impoundment or impoundment system shall have an in-line totalizing flow meter to read gallons, cubic feet, or cubic meters installed prior to beginning the permitted use. Meters shall produce volume determinations within plus or minus 10% of actual flows. An alternative method for determining flow may be approved by the Department on a case-by-case basis. 9VAC25-610-140 A
7 b
 - a. A defective meter or other device must be repaired or replaced within 30 days.

- b. A defective meter is not grounds for not reporting withdrawals. During any period when a meter is defective, generally accepted engineering methods shall be used to estimate withdrawals. The period during which the meter was defective must be clearly identified in the groundwater withdrawal report required by Part I, Subsection D of this permit.
2. Each well shall be equipped in a manner such that water levels can be measured during pumping and non-pumping periods without dismantling any equipment. Any opening for tape measurement of water levels shall have an inside diameter of at least 0.5 inches and be sealed by a removable plug or cap. The Permittee shall provide a tap for taking raw water samples from each permitted well. 9VAC25-610-140 A 7 e

J. Minor Modifications

1. A minor modification to this permit must be made to replace an existing well(s) or add an additional well(s) provided that the well(s) is screened in the same aquifer(s) as the existing well(s), and is in the near vicinity of the existing well(s), the total groundwater withdrawal does not increase, the area of impact does not increase, and the well has been approved by the Department prior to construction. 9VAC25-610-330 B 4 and B 5
2. A minor modification to this permit must be made to combine withdrawals governed by multiple permits when the systems are physically connected as long as interconnection will not result in additional groundwater withdrawal and the area of impact will not increase. 9VAC25-610-330 B 6
3. Minor modifications to this permit must also be made to:
 - a. Change an interim compliance date up to 120 days from the original compliance date, as long as the change does not interfere with the final compliance date. 9VAC25-610-330 B 7
 - b. Allow for change in ownership when the Department determines no other change in the permit is necessary and the appropriate written agreements are provided in accordance with the transferability of permits and special exceptions. 9VAC25-610-320 and 9VAC25-610-330 B 8
 - c. Revise a Water Conservation and Management Plan to update conservation measures being implemented by the Permittee that increase the amount of groundwater conserved. 9VAC25-610-330 B 9

K. Well Construction

At least two weeks prior to the scheduled construction of any well(s), the Permittee shall notify the Department of the construction timetable and receive prior approval of the well(s) location(s) and acquire the Department Well number (DEQ Well #). All wells shall be constructed in accordance with the following requirements.

1. A well site approval letter or well construction permit must be obtained from the Virginia Department of Health prior to construction of the well. 9VAC25-610-130 A

2. A complete suite of geophysical logs (16"/64" Normal, Single Point, Self-Potential, Lateral, and Natural Gamma) shall be completed for the well and submitted to the Department along with the corresponding completion report. 9VAC25-610-140 C
3. The Permittee shall evaluate the geophysical log and driller's log information to estimate the top of the target aquifer and; therefore, a depth below which the pump shall not be set. The Permittee's determination of the top of the target aquifer shall be submitted to the Department for review and approval, or approved on site by the Department's Groundwater Characterization staff, prior to installation of any pump. 9VAC25-610-140 A 6
4. The Permittee shall install gravel packs and grout in a manner that prevents leakance between aquifers. Gravel pack shall be terminated close to the top of the well screen(s) and shall not extend above the top of the target aquifer. 9VAC25-610-140 C
5. A completed GW-2 Form and any additional water well construction documents shall be submitted to the Department within 30 days of the completion of any well and prior to the initiation of any withdrawal from the well. The assigned Department Well number shall be included on all well documents. 9VAC25-610-140 C
6. In addition to the above requirements, if required by the permit, construction of a Water Level Monitoring State Observation Well (SOW) requires:
 - a. The Permittee shall coordinate activities with the Department's Groundwater Characterization Program (GWCP) to determine the appropriate observation well location and construction schedule, along with the needed screen interval(s), and other completion details following review of geophysical logging. 9VAC25-610-140 C
 - b. Prior to preparation of bid documents for construction of the observation well, the Permittee shall notify the Department and shall include any GWCP requirements in the bid documents. At a minimum, the Department will require a pre-bid meeting with interested drilling contractors and a pre-construction meeting with the successful bidder. 9VAC25-610-140 C
 - c. Instrumentation to meet the requirements for real-time data transmission consistent with the State Observation Well Network shall be purchased by the Permittee. The Permittee shall submit a purchase order based on the Department's equipment specifications for review and approval prior to purchase of the equipment. The Permittee shall install the real-time equipment infrastructure with Department oversight. The Department will conduct the installation of the transducer and final hook-up of the equipment. 9VAC25-610-140 C
7. In addition to the above requirements, if required by the permit, construction of a Chloride Monitoring SOW requires:
 - a. The Permittee shall coordinate activities with the Department's Groundwater Characterization Program (GWCP) to determine the appropriate observation well location and construction schedule, along with the needed screen interval(s), and other completion details following review of geophysical logging. 9VAC25-610-140 C
 - b. Prior to preparation of bid documents for construction of the observation well, the Permittee

shall notify the Department and shall include any GWCP requirements in the bid documents. At a minimum, the Department will require a pre-bid meeting with interested drilling contractors and a pre-construction meeting with the successful bidder. 9VAC25-610-140 C

- c. Instrumentation to meet the requirements for real-time data transmission consistent with the State Observation Well Network shall be purchased by the Permittee. The Permittee shall submit a purchase order based on the Department's equipment specifications for review and approval prior to purchase of the equipment. The Permittee shall install the real-time equipment infrastructure with Department oversight. The Department will conduct final hook-up of the equipment. 9VAC25-610-140 C
- d. Instrumentation to meet the requirements for continuous measurement of specific conductance from multiple levels within the well screen shall be purchased by the Permittee. The Permittee shall submit a purchase order based on the Department's equipment specifications for review and approval prior to purchase of the equipment. The Permittee shall install the real-time equipment infrastructure with Department oversight. The Department will conduct the final hook-up of the equipment. 9VAC25-610-140 C

L. Permit Reopening

This permit may be reopened for the purpose of modifying the conditions of the permit as follows:

- 1. To meet new regulatory standards duly adopted by the Board. 9VAC25-610-140 A 11
- 2. When new information becomes available about the permitted withdrawal, or the impact of the withdrawal, which had not been available at permit issuance and would have justified the application of different conditions at the time of issuance. 9VAC25-610-310 B 1
- 3. When the reported withdrawal is less than 60% of the permitted withdrawal amount for a five year period. 9VAC25-610-310 B 2
- 4. If monitoring information indicates the potential for adverse impacts to groundwater quality or level due to this withdrawal. 9VAC25-610-140 C

**COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY****PERMIT ISSUANCE FACT SHEET**

Groundwater Withdrawal Permit Number: GW0022600

Application Date: May 15, 2019

The Department of Environmental Quality (Department or DEQ) has reviewed the application for a Groundwater Withdrawal Permit. This document provides the pertinent information concerning the legal basis, scientific rationale, and justification for the issuance/reissuance/modification of the Groundwater Withdrawal Permit listed below. Based on the information provided in the application and subsequent revisions, the Department has determined that there is a reasonable assurance that the activity authorized by the permit is a beneficial use as defined by the regulations. Groundwater impacts have been minimized to the maximum extent practicable. The following details the application review process and summarizes relevant information for developing the Permit and applicable conditions.

Permittee / Legal Responsible Party

Name & Address: Riverside Healthcare Association, Inc.
701 Town Center Drive, Suite 1000
Newport News, VA 23606
Phone: (757) 875-2073

Facility Name and Address

Name & Address: Patriots Colony at Williamsburg
6000 Patriots Colony Drive
Williamsburg, VA 23188
Phone: (757) 585-7054

Contact Information:

Name: Erik Morgan
E-mail: Erik.Morgan@rivhs.com
Phone: (757) 585-7054

Proposed Beneficial Use: Commercial irrigation.

Staff Findings and Recommendations

Based on review of the permit application, staff provides the following findings.

- The proposed activity is consistent with the provisions of the Ground Water Management Act of 1992, and will protect other beneficial uses.
- The proposed permit addresses minimization of the amount of groundwater needed to provide the intended beneficial use.
- The effect of the impact will not cause or contribute to significant impairment of state waters.

Staff recommends Groundwater Withdrawal Permit Number GW0022600 be issued as proposed.

Approved:

Scott Morris, DBA, P.E.
Director, Water Division

Date:

Processing Dates

Processing Action	Date Occurred/Received
Preapplication Meeting:	March 19, 2019
Application Received by DEQ:	May 15, 2019
Permit Fee Deposited by Accounting:	April 12, 2019
Application Review Conducted:	June 28, 2022
Notice of Deficiency Sent	NA
Request for Additional Information Sent:	June 28, 2022
Request for Additional Information Received:	July 27, 2022
Local Government Ordinance Form Received by DEQ:	May 5, 2019
Application Complete:	November 21, 2022
Submit Request for Technical Evaluation:	January 23, 2023
Technical Evaluation Received:	January 31, 2023
Draft Permit Package Sent:	April 12, 2023
Submit Draft Permit for Public Notice:	
Public Notice Published:	
End of 30-Day Public Comment Period:	
Response to Public comment:	
Public Meeting or Hearing:	

Application

Application Information**Background/Purpose of Facility:**

The proposed withdrawal is to supply irrigation water for residential lots and common areas within the Patriots Colony retirement community. The facility has an approximately 90-acre campus with assisted living facilities, medical/healthcare buildings, meeting and recreational buildings, single-family homes, apartments, and nature trails. The facility's irrigation system provides water to approximately 16.21 acres of landscaping. The facility has not been permitted previously to withdraw groundwater.

Location of Facility/Withdrawal:

Water Supply Planning Unit: Hampton Roads PDC

County: James City County

GWMA/Aquifer: Eastern Virginia GWMA/Potomac aquifer

Conjunctive Use Source: No conjunctive use.

Withdrawal Use, Current Need, and Projected Demand:

Basis of Need:

The facility's irrigation system provides water to approximately 16.21 acres of landscaping. The irrigation system consists of separate controllers that operate the four irrigation wells individually. The system is operated by timer and is programmed by season, with adjustments made throughout irrigation season, as well as by visual inspection (appearance) of the turf. The irrigation season typically runs from mid-April through mid- to late-October depending on when over-seeding for the next season occurs.

A separate electromagnetic rain gauge sends data to the pump controller and prevents the pump from activating if sufficient rainfall (one-quarter inch or more) has occurred. Irrigation occurs between 10:00PM and 8:00AM in the spring and fall for about 10 minutes two times per week and in the summer for 20 minutes about three times per week. The facility employs Kentucky-31 tall fescue for all irrigated/landscaped areas, which is drought-resistant and less water intensive than some other turf grass.

Water Demand: Current Need and Projections:

Irrigation occurs on an as-needed basis, primarily depending on the amount of precipitation received and the turf grass evapotranspiration (ET) rate. A soil/grass water demand model using historic weather over a 15-year period (2004-2018) was developed to estimate the volumes of water that will be required at the facility on a maximum monthly and annual basis. The water demand model was used as an alternative to long-term historical irrigation water use records, which were not available for the facility.

In a comparison of the total model-predicted irrigation requirements for 2018, with measured irrigation applied as determined from the newly installed flowmeters, there is indication of a strong agreement between the model and actual irrigation. The model was within 2 to 20% of the actual volume applied, depending on when the irrigation season was simulated to begin.

Details for the water demand model calculations are provided in the permit application.

The maximum monthly irrigation demand from the 15-year soil-water demand model was added to the possible volume needed to bring the soil to available water capacity (AWC) at the beginning of the irrigation season. The maximum monthly estimated demand was rounded to the nearest 100,000 gallons.

The maximum annual irrigation demand was based on the highest calculated usage year from the 15-year gross water demand model plus an allowance for early season irrigation to bring the soil to field capacity. This volume was then rounded the nearest 100,000 gallons.

Withdrawal Volumes Requested:

The applicant requested the following withdrawal volumes based upon the projected groundwater demand.

Period of Withdrawal	Total Volume (gal)	Volume in gal/day
Maximum Monthly:	2,700,000	87,097
Maximum Annual:	7,500,000	20,548

Department Evaluation

Historic Withdrawals:

The applicant does not have historic withdrawal records, so a soil-water demand model was created and utilized by the applicant to determine water demands for the 15-year permit.

Analysis of Alternative Water Supplies:

The nearest major surface water body is a tributary of the James River, located approximately one-half mile to the southwest of the facility. The James and this tributary are tidal and brackish in this area, making the water quality unusable for landscape irrigation without expensive treatment. The costs to permit, install, and operate an intake on the river, and run a water main to the facility, would be prohibitive.

The facility is prohibited from using public water from JCSA for irrigation without the prior approval of the General Manager of JCSA. The JCSA *Water Conservation Guidelines Revision* (November 27, 2007) states that "if a development requires irrigation, water other than that used for the public supply should be used..." and "in no circumstance shall JCSA public water supply water...be used for irrigation..." Therefore, the facility would not likely be allowed to use JCSA water supply for irrigation. Additionally, JCSA's water supply is sourced from the same deep aquifer (Potomac) as the facility's existing irrigation wells and as such, obtaining water from JCSA does not present a net benefit to the aquifer.

James City County restricts new wells to a maximum depth of 100 feet. In August 2017, Toano Well & Pump drilled an irrigation well in the eastern area of the facility to support new apartment buildings being constructed. This shallow test well was drilled to a total depth of 98 feet and constructed with a screened interval from 20 to 60 feet. Based on lithology's reported in the Well Completion Report (GW-2 Form) and discussions with Department staff, this well is believed to have been screened in the Surficial/Water Table aquifer, which also corresponds to the Yorktown-Eastover aquifer in this area. The drilling contractor reported a yield of only 2.6 gallons per minute (gpm) following a four-hour pumping test. Because of the low yield of this initial shallow test well, the facility opted not to tie it into the irrigation system, and Toano Well Drilling permanently abandoned this well in July 2018.

In the spring and summer of 2018, Cardno conducted a phased investigation of the shallow aquifers in collaboration with DEQ. Results of the investigation indicated that the shallow wells at the facility would have lower yields, and the facility would need to install upwards of 100 shallow wells to meet demand. Therefore, based on the results of the investigation, the shallow aquifers at the facility are not a viable alternative source for the irrigation system.

Another alternate source of water that was considered for the irrigation system is stormwater, which would need to be captured and stored in retention basins ("wet ponds"). With the exception of one wet pond located behind the bistro, all existing stormwater ponds are detention basins ("dry ponds") that hold water for brief periods of time, so would be insufficient for irrigation use. this wet pond/bioretention basin behind the bistro does not have sufficient acreage to create enough water storage for use in turf irrigation.

Finally, creation of additional, new wet ponds on the facility is prohibited by the current development of the facility and buffer requirements (e.g., proffers), such that additional construction on the facility after completion of the new apartment complex is not possible.

Public Water Supply:

The proposed beneficial use does not contain a public water supply component. Potable water is supplied by James City County.

Water Supply Plan Review:

Patriots Colony is not included in the Hampton Roads Regional Water Supply Plan (2011). Water Supply Plan demand projections for the facility were not included in the Plan, and could not be considered in the evaluation of the permit request. The Water Supply Plan states that existing sources for the York-James Peninsula Sub-Region (containing Patriot's Colony) were not projected to meet demands through 2050.

Department Recommended Withdrawal Limits:

Department staff reviewed the water demand and projections provided by the applicant. The water demand justifications for the annual and monthly limits were justified to meet the beneficial use and need identified for the commercial irrigation operation.

The Department recommends the following withdrawal volumes based upon evaluation of the groundwater withdrawal permit application.

Period of Withdrawal	Total Volume (gal)	Volume in gal/day
Maximum Monthly:	2,700,000	87,097
Maximum Annual:	7,500,000	20,548

Technical Evaluation:

Aquaveo, LLC performed a technical evaluation of the application for the Department based on the VAHydro Groundwater Eastern Virginia Model (VAHydro-GW-VCPM). The objectives of this evaluation were to determine the areas of any aquifers that will experience at least one foot of water level decline due to the proposed withdrawal (the Area of Impact or AOI), to determine the potential for the proposed withdrawal to cause salt-water intrusion, and to determine if the proposed withdrawal meets the 80% drawdown criteria. Aquaveo, LLC also evaluated water levels in the Eastern Virginia Model compared to measured field values.

The Department concluded that the proposed withdrawal satisfies the technical evaluation criteria for permit issuance. A summary of the results of the evaluation and the AOI for the aquifers is provided in the Technical Evaluation (Attachment 1).

Part I
Operating Conditions

Authorized Withdrawals:

Owner Well Name	DEQ Well #	Aquifer	Type	Pump Intake Limit (ft/bls)
Well at Villa 3 (Well #3)	147-00345	Potomac	Production	300
Green Springs Well (Well #4)	147-00346	Potomac	Production	300
Well at Villa 8 (Well #5)	147-00347	Potomac	Production	303
Resident Wood Shop Well (Well #6)	147-00348	Potomac	Production	303

Apportionment:

Given that the four wells are screened in the same source Potomac aquifer and are within a single DEQ VAHydroGW groundwater model cell, no individual apportionment limits are necessary.

Additional WellsAbandoned Wells:

Owner Well Name	DEQ Well #	Aquifer
Well One	147-00343	Unknown
Well Two	147-00344	Unknown
2017 Test Well	None assigned	Columbia (Surficial)

Out of Service Wells:

Owner Well Name	DEQ Well #	Aquifer
Shallow Well #2	147-00340	Columbia (Surficial)
Shallow Well #3	147-00341	Columbia (Surficial)

Pump Intake Settings:

Department staff have reviewed available information and made the following determinations regarding the location of the aquifer tops for the following wells. Information reviewed in this process included GW-2 forms, driller's logs, geophysical logs for Well #4, and the Virginia Coastal Plain Hydrogeologic Framework (USGS Professional Paper 1731).

Unit	DEQ Well #147-00345 (ft/bls)	DEQ Well #147-00346 (ft/bls)	DEQ Well #147-00347 (ft/bls)	DEQ Well #147-00348 (ft/bls)
Columbia bottom		Not Delineated		
Yorktown-Eastover		Not Delineated		
Piney Point		130-200		
Aquia top		250-300		
Potomac confining unit		absent		
Potomac top		300		

The well pump setting for all wells except Green Springs Well (Well #4) (DEQ Well #147-00346) are correctly positioned in accordance with 9VAC25-610-140 A 6. Green Springs Well (Well #4) (DEQ Well #147-00346) has a pump setting of 321.3 feet below land surface and will need to be raised to no deeper than 300 feet below land surface.

Water Conservation and Management Plan:

A Water Conservation and Management Plan (WCMP) meeting the requirements of 9VAC25-610-100 B was submitted and reviewed as part of the application process. The accepted Plan is to be followed by the permittee as an operational Plan for the facility/water system, is incorporated by reference into this permit, and shall have the same effect as any condition contained in this permit and may be enforced as such (Attachment 2). In addition, the Permit includes conditions requiring a leak detection and repair program that includes the following:

- Documentation that the leak detection and repair program defined in the WCMP has been initiated is due by the end of the first year of the permit term.

- A result of an audit of the total amount of groundwater used in the distribution system and operational processes is due by the end of the second year of the permit term.
- A report on the plan's effectiveness in reducing water use, including revisions to those elements of the WCMP that can be improved and addition of other elements found to be effective based on operations to date shall be submitted by the end of years five [date] and ten [date] of the permit term.

Mitigation Plan:

The predicted AOI resulting from the Technical Evaluation could not be defined in the Potomac aquifer because the maximum drawdown estimated from the simulation was less than one foot at the wellbore. A Mitigation Plan was therefore not required for the permit.

Well Tags: Well tags will be transmitted by the Department after issuance of the final permit.

Part II
Special Conditions

With the exception of conditions listed below, review of the applicant's application, well construction data, operations at the facility, and the Technical Evaluation of the application did not identify a need for water quality or water level monitoring in the permit. There are no new wells currently planned for construction during the permit term. Technical Evaluation of the application was based on model parameters and aquifer testing is not required at this time. Construction of observation wells or well nests, and geophysical boreholes to assist in monitoring or characterizing the local or regional aquifer system are not required at this time.

Pump Intake Reset:

Within one year, the Permittee shall ensure the pump intake for the Green Springs Well (Well #4) (DEQ Well #147-00346) is at or above the stated maximum pump setting as provided in feet below land surface (ft. bls). The Permittee shall advise the Department, in writing, of the new pump setting within 30 days of the modification.

Well Abandonments:

Out of service wells that have not been permanently abandoned per VDH regulations can provide a pathway for surface contaminants to enter subsurface aquifers or other means of adverse impact to the aquifer system. Well One (DEQ #147-00343) and Well Two (DEQ#147-0344) were presumed to be abandoned or capped but no documentation was located to clarify the status. Therefore, the status of the well will need to be verified and if found to be not abandoned, abandonment according to VDH regulations will be necessary. The permit requires verification and if necessary, abandonment 270 days before reapplication.

Part III
General Conditions

General Conditions are applied to all Groundwater Withdrawal Permits, as stated in the Groundwater Withdrawal Regulations, 9VAC25-610.

Public Comment

The following sections will be completed after close of the public comment period.

Relevant Regulatory Agency Comments:

Summary of VDH Comments and Actions:

This facility is not a public water supply so soliciting comments from VDH was not required.

Public Involvement during Application Process:

Local and Area wide Planning Requirements:

The James City County Administrator certified on April 4, 2019, that no local ordinances were in effect regarding the facility's operations. The Department received this certification on May 5, 2019.

Public Comment/Meetings:

The public notice was published in xxxxxx on XXX. The public comment period ran from xxxxx to xxxxx

Changes in Permit Part II Due to Public Comments

Changes in Permit Part III Due to Public Comments

Attachments

1. Technical Evaluation
2. Water Conservation Plan
3. Public Comment Sheet *(if warranted)*

**COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY**

TECHNICAL EVALUATION FOR PROPOSED GROUNDWATER WITHDRAWAL

Date: January 23, 2023

Application /Permit Number: GW0022600

Owner / Applicant Name: Riverside Healthcare Association, Inc.

Facility / System Name: Patriots Colony at Williamsburg

Facility Type: Commercial

Facility / System Location: 6000 Patriots Colony Drive, Williamsburg, VA 23188

The Commonwealth of Virginia's Groundwater Withdrawal Regulations (9VAC25-610) provide that, for a permit to be issued for a new withdrawal, to expand an existing withdrawal, or reapply for a current withdrawal, a technical evaluation shall be conducted. This report documents the results of the technical evaluation conducted to meet the requirements for the issuance of a permit to withdraw groundwater within a Designated Groundwater Management Area (9VAC25-600).

This evaluation determines the:

- (1) The Area of Impact (AOI): The AOI for an aquifer is the areal extent of each aquifer where one foot or more of drawdown is predicted to occur as a result of the proposed withdrawal.
- (2) Water Quality: The potential for the proposed withdrawal to cause salt water intrusion into any portion of any aquifers or the movement of waters of lower quality into areas where such movement would result in adverse impacts on existing groundwater users or the groundwater resource.
- (3) The Eighty Percent Drawdown (80% Drawdown): The proposed withdrawal in combination with all existing lawful withdrawals will not lower water levels, in any confined aquifer that the withdrawal impacts, below a point that represents 80% of the distance between the land surface and the top of the aquifer at the points where the one-foot drawdown contour is predicted for the proposed withdrawal.

Requested withdrawal amount:

Requested Withdrawal Amount		
Annual Value	7,500,000	(20,548 average gpd)
Monthly Value	2,700,000	(87,097 average gpd)

Requested Apportionment of Withdrawal:

DEQ Well #	Owner Well #	Aquifer	Percent of Withdrawal*
147-00345	Well at Villa 3 (#3)	Potomac	25
147-00346	Green Springs Well (#4)	Potomac	25
147-00347	Well at Villa 8 (#5)	Potomac	25

147-00348	Resident Wood Shop Well (#6)	Potomac	25
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*The percentage of withdrawal from each well is expected to vary making the percentage estimate difficult. Given this, the withdrawal was spread evenly between the wells.

Summary of Requested Withdrawal:

The groundwater withdrawal system supports the irrigation needs for the 90-acre Patriot's Landing campus. The campus includes medical healthcare buildings, assisted living quarters, meeting and recreational buildings, independent living quarters, individual homes and apartments with nature trails and garden areas. There are 68 villas and 150 apartments at the campus. About 16.21 acres of lawn and any new shrubs are irrigated. The system operates from mid-April to late October.

Production Wells:

Identification	Location	Construction	Pump Intake	Source Aquifer
Owner Well Name: Well at Villa 3 (Well #3) DEQ Well Number: 147-00345 MPID:	Lat: 37° 15' 23.324" Lon: 76° 48' 36.727" Datum: NAD83 Elevation: 36.35 ft-msl	Completion Date: Oct 10, 1996 Driller: Gammon Screens (ft/bls): 397.35-416.02 Total Depth (ft/bls): 420	168.3	Potomac
Owner Well Name: Green Springs Well (Well #4) DEQ Well Number: 147-00346 MPID:	Lat: 37° 15' 31.279" Lon: 76° 48' 40.274" Datum: NAD83 Elevation: 36.58 ft-msl	Completion Date: August 2, 2001 Driller: Sydnor Screens (ft/bls): 385.97-395.95 417.47-427.47 Total Depth (ft/bls): 428.6	321.3	Potomac
Owner Well Name: Well at Villa 8 (Well #5) DEQ Well Number: 147-00347 MPID:	Lat: 37° 15' 15.669" Lon: 76° 48' 31.767" Datum: NAD83 Elevation: 39.88 ft-msl	Completion Date: Unknown Driller: Unknown Screens (ft/bls): 420.54-466.77 Total Depth (ft/bls): 466.77	171.8	Potomac
Owner Well Name: Resident Wood Shop Well (Well #6) DEQ Well Number: 147-00348 MPID:	Lat: 37° 15' 25.937" Lon: 76° 48' 23.630" Datum: NAD83 Elevation: 39.98	Completion Date: Unknown Driller: Unknown Screens (ft/bls): 425.2-445.45 Total Depth (ft/bls): 445.45	280.37	Potomac

Out of Service Well(s):

Identification	Location	Construction	Pump Intake	Source Aquifer
Owner Well Name: Shallow Well #1 DEQ Well Number: 147-00339 MPID: None assigned	Lat: 37° 15' 13.216" Lon: 76° 38' 30.162" Datum: NAD83 Elevation:	Completion Date: Screens (ft/bls): Total Depth (ft/bls):	No pump	Columbia
Owner Well Name: Shallow Well #2 DEQ Well Number: 147-00340 MPID: None assigned	Lat: 37° 15' 14.339" Lon: 76° 48' 25.147" Datum: NAD83 Elevation:	Completion Date: 9/26/18 Screens (ft/bls): 15-45 Total Depth (ft/bls): 45	No pump	Columbia
Owner Well Name: Shallow Well #3 DEQ Well Number: 147-00341 MPID: None assigned	Lat: 37° 15' 26.340" Lon: 76° 48' 36.755" Datum: NAD83 Elevation:	Completion Date: 9/6/2018 Screens (ft/bls): 10-40 Total Depth (ft/bls): 40	No pump	Columbia

Abandoned Well(s):

Identification	Location	Construction	Pump Intake	Source Aquifer
Owner Well Name: Well One (presumed abandoned) DEQ Well Number: 147-00343 MPID: None assigned	Lat: Lon: Datum: Elevation:	Completion Date: Screens (ft/bls): Total Depth (ft/bls):	N/A	Unknown
Owner Well Name: Well Two (presumed abandoned) DEQ Well Number: 147-00344 MPID: None assigned	Lat: Lon: Datum: Elevation:	Completion Date: Screens (ft/bls): Total Depth (ft/bls):	N/A	Unknown
Owner Well Name: 2017 Test Well DEQ Well Number: MPID: None assigned	Lat: 37° 15' 13.032" Lon: 76° 48' 25.939" Datum: WGS84 Elevation:	Completion Date: Screens (ft/bls): 20-60 Total Depth (ft/bls): 98	N/A	Columbia

Observation Well(s): There are no observation wells associated with the system.

Geologic Setting:

The Patriots Colony at Williamsburg wells (applicant wells) are located in James City County. The applicant's production wells are screened in the Potomac aquifer. USGS Professional Paper 1731¹, *The Virginia Coastal Plain Hydrogeologic Framework* (VCPHF), is the most recent study discussing the aquifers and confining units of the Virginia Coastal Plain. The study utilized numerous boreholes throughout the Virginia Coastal Plain to interpolate the elevations of the different hydrogeologic units found in the Coastal Plain.

According to the study, the Potomac aquifer is the "largest, deepest, and most heavily used source of ground water in the Virginia Coastal Plain." The aquifer is underlain across its entire extent with basement bedrock. The aquifer is found below the Potomac confining zone. The aquifer is primarily composed "of fluvial-deltaic coarse-grained quartz and feldspar sands and gravels and interbedded clays."

The nearest east-west geologic cross section, ED-ED', from the USGS Professional Paper 1731 is shown in the figure at the end of this report.

Hydrologic Framework:

Data from the VCPHF is reported in this technical report to illustrate the hydrogeologic characteristics of the aquifers in the Virginia Coastal Plain near the applicant well and identify major discrepancies between regional hydrogeology and site logs interpreted by DEQ staff. The Virginia Coastal Plain Model² (VCPM) framework was constructed by extracting the hydrogeologic unit tops and thicknesses from the VCPHF. The original USGS VCPM was updated and adapted for use in the VA-DEQ well permitting process and is referred to as VAHydroGW-VCPM.

VAHydroGW-VCPM Model:

The following table lists the locations of the applicant production wells within the VAHydroGW-VCPM Model.

VAHydroGW-VCPM Model Grid				
Well	Well Number	MPID	Row	Column
Well at Villa 3 (Well #3)	147-00345	N/A	80	40
Green Springs Well (Well #4)	147-00346	N/A	80	40
Well at Villa 8 (Well #5)	147-00347	N/A	80	40
Resident Wood Shop Well (Well #6)	147-00348	N/A	80	40

The following aquifer top elevations and thicknesses are simulated in the VAHydroGW-VCPM Model at the model cell containing the applicant wells.

¹ McFarland E. R., and Bruce T.S., 2006. The Virginia Coastal Plain Hydrologic Framework: U.S. Geologic Survey Professional Paper 1731. 118 p., 25 pls. (available online at <http://pubs.water.usgs.gov/pp1731/>).

² Heywood, C.E., and Pope, J.P., 2009, Simulation of groundwater flow in the Coastal Plain aquifer system of Virginia: U.S. Geological Survey Scientific Investigations Report 2009-5039, 115 p.

VAHydroGW-VCPM Model Hydrogeologic Unit Information		
Aquifer	Elevation (ft-msl)	Depth (ft-bls)
Surface	18	0
Water Table aquifer (bottom)	-7	25
Yorktown-Eastover (top)	-7	25
Yorktown-Eastover (bottom)	-22	40
Piney Point (top)	-95	113
Piney Point (bottom)	-154	172
Aquia (top)	-206	224
Aquia (bottom)	-237	255
Potomac (top)	-252	270
Potomac (bottom)	-1136	1154

Note: ft-msl = feet above mean sea level

Groundwater Characterization Program Recommendations:

Department staff have reviewed available information and made the following determinations regarding the location of the aquifer tops for the following wells. Information reviewed in this process included GW-2 forms, driller's logs, geophysical logs for Well #4, and the Virginia Coastal Plain Hydrogeologic Framework (USGS Professional Paper 1731).

Unit	Well #3 (ft/bls)	Well #4 (ft/bls)	Well #5 (ft/bls)	Well #6 (ft/bls)
Columbia bottom		Not Delineated		
Yorktown-Eastover		Not Delineated		
Piney Point		130-200		
Aquia top		250-300		
Potomac confining unit		absent		
Potomac top		300		

Comparison of the Hydrogeologic Framework and Geologist Report:

The VCPMF identifies the top and thickness of the Potomac aquifer at an elevation of 270 ft-bls and 884 feet thick at the cell containing the applicant wells. The top elevation of the Potomac aquifer given by DEQ staff is 300 ft-bls. The top elevation of the Potomac aquifer identified by the VCPMF is 30 feet higher than, but in general agreement with the value provided by DEQ staff. The thickness of the Potomac was not provided by the DEQ so a comparison to the VCPMF could not be made.

Pump Intake Elevation:

Virginia regulations specify that well pump intakes must be placed at or above the top of the source aquifer. Based on a review of available site information by DEQ staff, the pump intake elevation for Green Springs Well (Well #4) is not in compliance with the limits specified by regulation³. An assessment of the compliance of the pump intake elevations for the other three wells could not be made since the top elevations of the Potomac aquifer at those three wells was not provided.

³ 9 VAC 25 610 140.A.5. "The permittee shall not place a pump or water intake device lower than the top of the uppermost confined aquifer that a well utilizes as a ground water source or lower than the bottom of an unconfined aquifer that a well utilizes as a ground water source;

Water Level Comparison:

The *Virginia Coastal Plain Model (VAHydroGW-VCPM) 2021-2022 Annual Simulation of Potentiometric Groundwater Surface Elevations of Reported and Total Permitted Use* report (the 2021-2022 report) and modeling files⁴ provide two sets of simulated potentiometric water surface elevations. These water elevations are based upon, 1) the reported withdrawal amount of wells in the VAHydroGW-VCPM model ("the reported use simulation") and, 2) the total permitted withdrawal amount for wells in the VAHydroGW-VCPM model ("the total permitted simulation"). USGS regional observation network well water levels were compared to the water levels in the 2021-2022 report in order to evaluate the performance of the regional model in the vicinity of the applicant wells and assess historical groundwater trends. In the tables below, simulated water levels from the year 2021, from the reported use simulation, were compared to USGS measured water levels for the same year. For comparison, the total permitted simulated water levels are also reported. The total permitted water levels are taken from the end of the 50 year total permitted simulation and represent simulated water levels, 50 years from present, if all GWMA wells were to pump at their total permitted amount.

The USGS regional observation network wells closest to the applicant wells are shown in Figure 1 and listed in the following tables. The depth of these wells corresponds with the Potomac aquifer. The distances from the applicant wells to the USGS wells are also given in the tables. The 2021 annual average water levels observed in the regional observation network wells are given in the following tables. The VAHydroGW-VCPM row and column containing the USGS wells are also given. The water levels obtained from the regional observation network wells are shown in Figures 2 and 3. These figures also show the water levels from the reported use VAHydroGW-VCPM simulation for the cell containing each USGS well.

The water level graph for the first well in the Potomac aquifer (56H 22 SOW 135A) shows a steady decline in water levels from the time of the earliest available records (1979) to about 2000. Between 2000 and the present there are significantly more annual fluctuations in the recorded water levels, with some years seeing up to twenty feet of change. The overall decline in water levels continued over the last twenty years, however over the last few years those water levels have begun to stabilize and even show a slight recovery. The VAHydroGW-VCPM simulated reported use water levels at this location are within a few feet of the USGS observed water levels up until the last ten years or so when the simulated values have been up to 10 feet higher than the USGS observed water levels, but are in general agreement.

The water level graph for the second well in the Potomac aquifer (57E 14 SOW 144A) also shows a steady decline in water levels from the time of the earliest available records (1980) to about 2010. From 2010 to the present the water levels have also increased steadily. The VAHydroGW-VCPM simulated reported use water levels at this location are within one to five feet of the USGS observed water levels and are therefore in general agreement.

⁴ Refer to "Virginia Coastal Plain Model (VAHydroGW-VCPM) 2021-2022 Annual Simulation of Potentiometric Groundwater Surface Elevations of Reported and Total Permitted Use" at <http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterCharacterization/ReportsPublications.aspx>

Potomac Aquifer		
Measurement	Well 56H 22 SOW 135A	Well 57E 14 SOW 144A
Distance from nearest applicant well (miles)	8.9	15.0
Elevation (ft-msl)	105	86
VAHydroGW-VCPM Row	71	94
VAHydroGW-VCPM Column	40	45
VAHydroGW-VCPM Cell Elevation	111	85
USGS Regional Well 2021 Average Water Level (ft-bls)	200.7	159.7
USGS Regional Well 2021 Average Water Level (ft-msl)	-95.7	-73.7
VAHydroGW-VCPM 2021 Reported Use Simulated Water Level (ft-bls)	196.7	156.2
VAHydroGW-VCPM 2021 Reported Use Simulated Water Level (ft-msl)	-85.7	-71.2
VAHydroGW-VCPM Total Permitted Simulated Water Level (ft-bls)	205.5	178.5
VAHydroGW-VCPM Total Permitted Simulated Water Level (ft-msl)	-94.5	-93.5

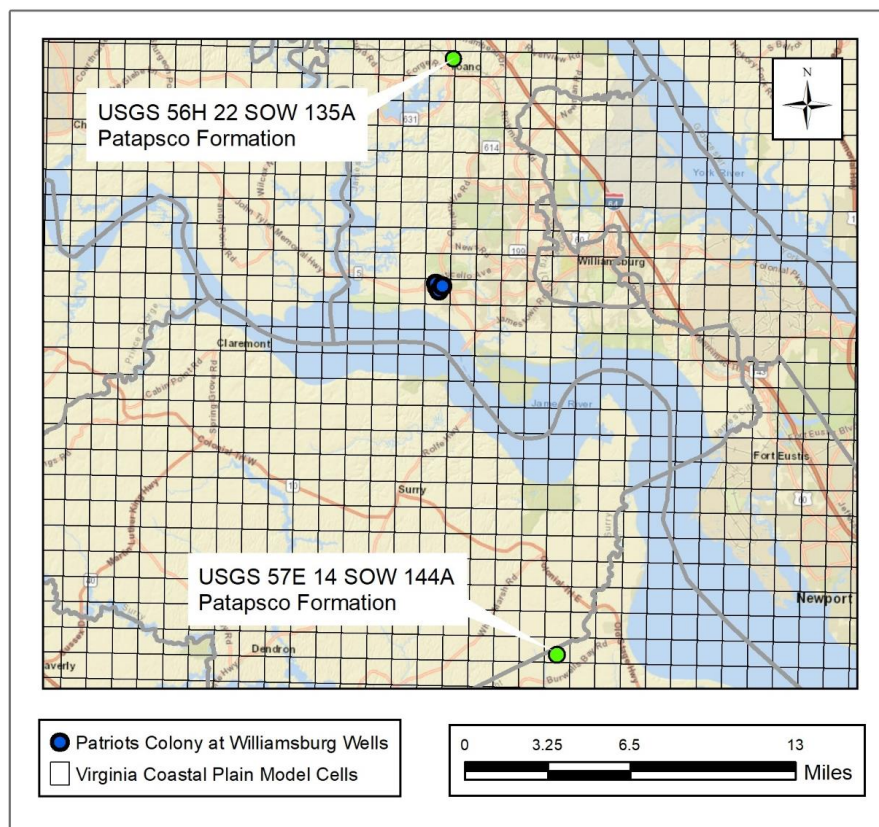


Figure 1. Nearest USGS regional observation network wells.

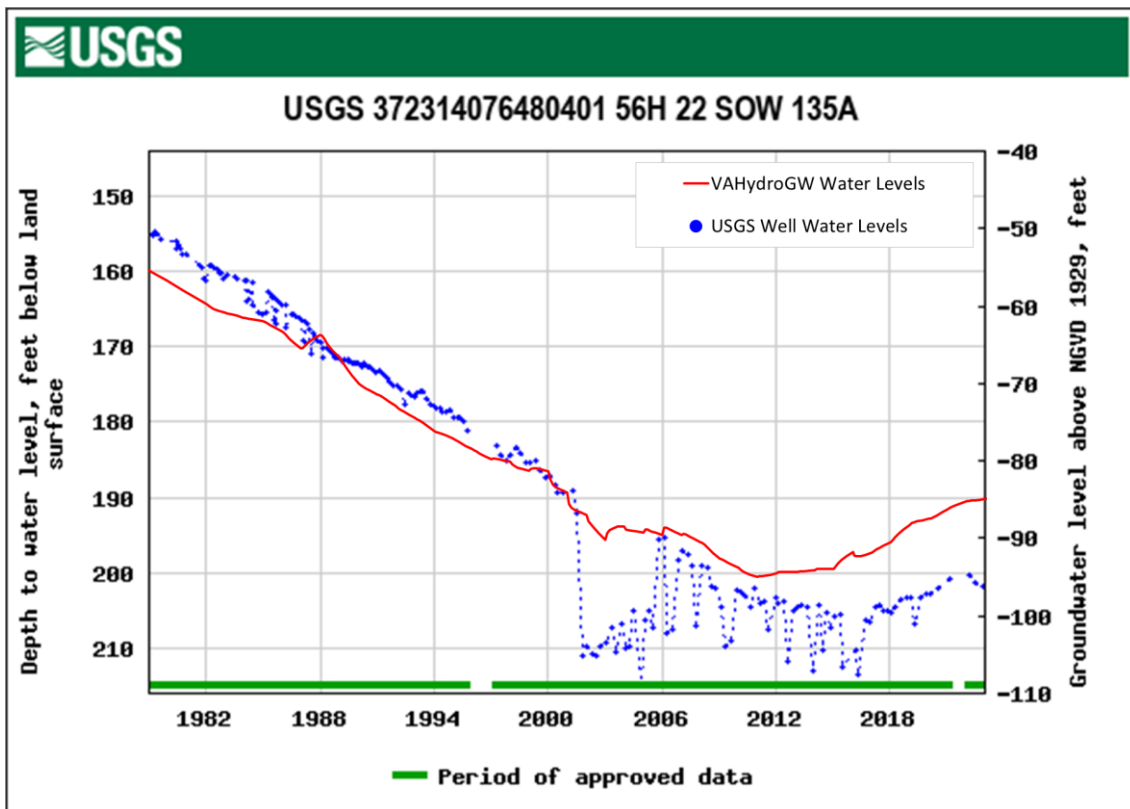


Figure 2. USGS Regional Observation Well 56H 22 SOW 135A, Potomac aquifer water levels (Patapsco Formation) recorded from 1979 to present (well depth 645 ft bls, land surface 105 ft msl) and VAHydroGW-VCPM reported use water levels.

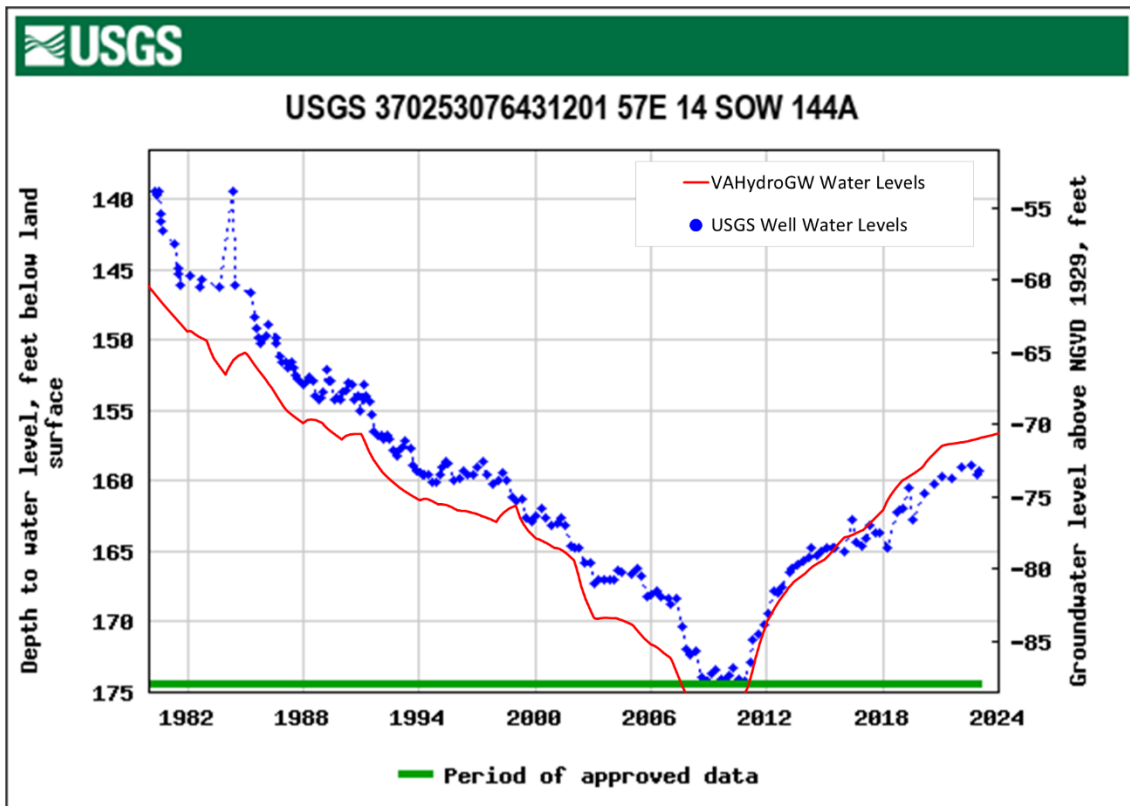


Figure 3. USGS Regional Observation Well 57E 14 SOW 144A, Potomac aquifer water levels (Patapsco Formation) recorded from 1980 to present (well depth 600 ft bls, land surface 86 ft msl) and VAHydroGW-VCPM reported use water levels.

Aquifer Test(s):

No aquifer tests have been conducted at the facility.

The hydraulic properties for the VAHydroGW-VCPM cell containing the applicant wells are shown in the following table.

Hydrogeologic Unit	Horizontal Conductivity (ft/day)	Transmissivity (ft ² /day)	Storage Coefficient	Specific Storage (1/ft)
Surficial (Columbia) aquifer	2	50	-	0.000032
Yorktown-Eastover aquifer	22.4	335.6	0.00048	0.000032
Piney Point aquifer	23.1	1,362.9	0.00190	0.000032
Aquia aquifer	109	3,379.0	0.00100	0.000032
Potomac aquifer	24.1	21,330.0	0.00164	0.000002

Model Results

Evaluation of Withdrawal Impacts:

The magnitude of the proposed withdrawal does not allow for assessment of the area of impact using VAHydroGW-VCPM. The aquifer parameters from the VAHydroGW-VCPM were used to perform a two-dimensional analytical simulation to simulate drawdown due to the requested withdrawal for this technical evaluation. The drawdown in the Potomac aquifer resulting from the proposed withdrawal was calculated using Theis (1935) 2-D analytical simulations. The Theis simulation predicts the drawdown in a confined aquifer assuming constant discharge from a fully penetrating well. For the 2-D analytical simulations the following parameters were used:

Model Input Parameters (source: VAHydroGW-VCPM model properties for row 80, col 40):

Potomac Transmissivity = 21,330 ft²/day
 Potomac Storage Coefficient = 1.64×10^{-3}

Withdrawal rate/Simulation Time = 50 years at 7,500,000 gallons per year (20,548 gallons per day).

Area of Impact:

The AOI for an aquifer is the areal extent of each aquifer where one foot or more of drawdown is predicted to occur as a result of the proposed withdrawal. The results from the Theis analytical simulation, with the parameters listed above, do not simulate an AOI in the Potomac aquifer because the simulated drawdown at the production wells is less than one foot.

Water Quality:

The regional model (VAHydroGW-VCPM) does not indicate any changes to regional flow patterns that would lead to reduced water quality.

80 % Drawdown:

With no area of impact, this withdrawal is within the limits set by the 80% drawdown criterion.

The requested withdrawal is allocated 100% to the Potomac aquifer. The technical evaluation analysis indicated that the apportionment of the requested withdrawal amount among the applicant production wells had no significant effect on the outcome of the technical evaluation.

Conclusion:

The withdrawal requested by Riverside Healthcare Association, Inc. for Patriots Colony at Williamsburg satisfies the technical evaluation criteria for permit issuance.

Patriots Colony at Williamsburg Area of Impact - Potomac Aquifer



- Patriots Colony at Williamsburg Wells
- Potomac AOI
- Potomac Aquifer Critical Cells

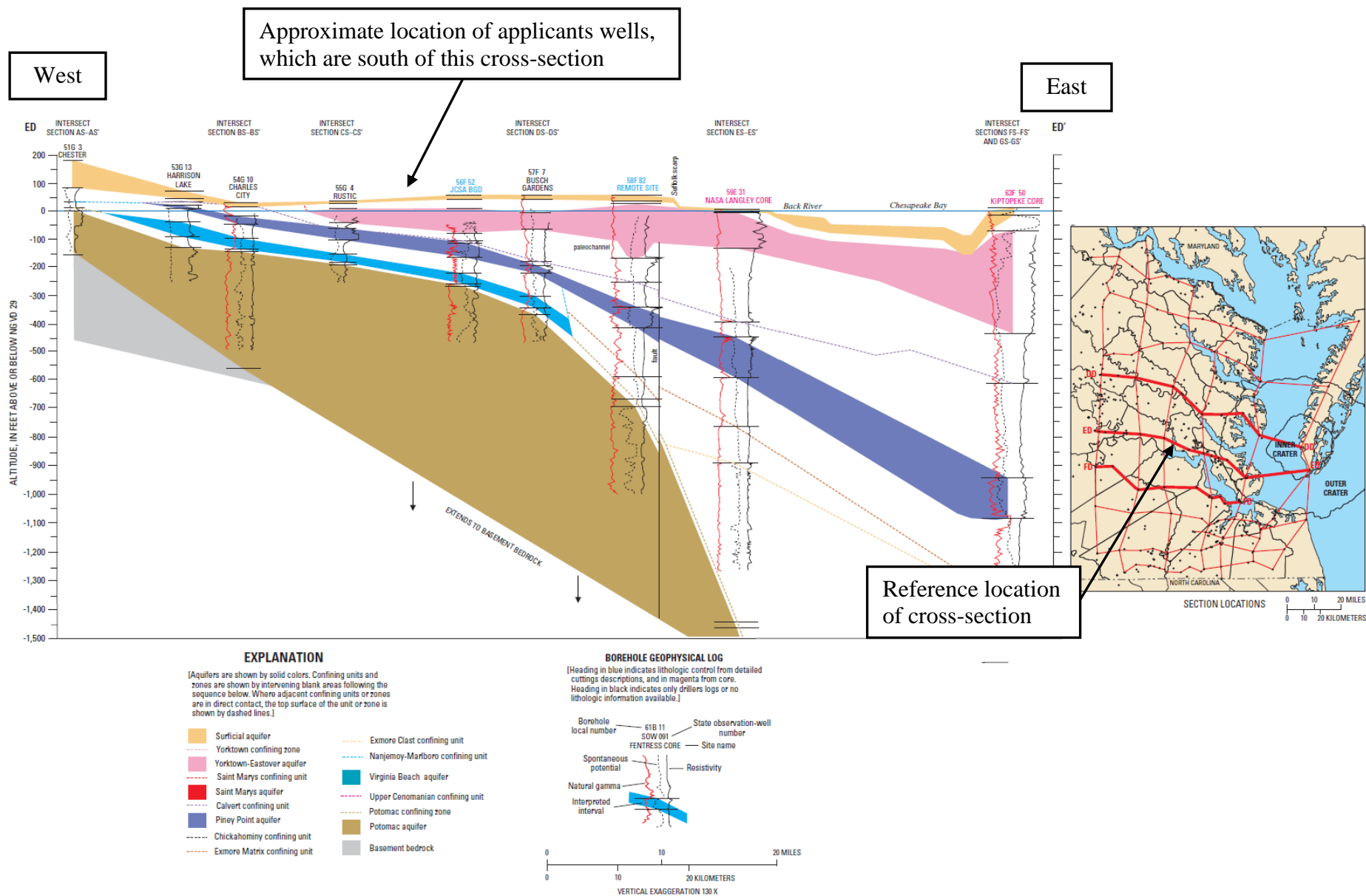


Simulated drawdown at or exceeding one foot in the Potomac aquifer resulting from a withdrawal of 7,500,000 gallons per year for 50 years from the Potomac aquifer using a two-dimensional Theis (1935) simulation.

Simulated drawdown is less than one foot.

Technical Evaluation performed by
Aquaveo, LLC for the Virginia DEQ,
Office of Water Supply Planning
January 31, 2023





Coastal Plain (2006) Cross Section ED-ED' from USGS Professional Paper 1731.



WATER CONSERVATION AND MANAGEMENT PLAN

PATRIOTS COLONY AT WILLIAMSBURG JAMES CITY COUNTY, VA

May 15, 2019

Prepared by:
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1 Introduction

On behalf of Riverside Healthcare Association, Inc. (RHA), Cardno, Inc. (Cardno) has prepared this Water Conservation and Management Plan (WCMP) pursuant to Virginia's Groundwater Management Act of 1992 (Title 62.1, Chapter 25) and corresponding Groundwater Withdrawal Regulations (9VAC 25-610), which require a Groundwater Withdrawal Permit (GWWP) for any entity located within either the Eastern Virginia or Eastern Shore Groundwater Management Area (GWMA) that withdraws 300,000 gallons of groundwater or more in any one month. This WCMP has been prepared in conjunction with the application for a new GWWP for the landscape irrigation system at the Patriots Colony at Williamsburg retirement community in James City County, Virginia (hereafter referred to as "Patriots Colony" or "the facility") to meet the Virginia Department of Environmental Quality (DEQ) requirements for a GWWP.

1.1 WCMP Requirements

A complete WCMP must satisfy the minimum requirements of 9VAC 25-610-100. For nonpublic water supply applicants – commercial and industrial users – such as Patriots Colony, the WCMP shall include the following:

1. Where applicable, the plan should require use of water-saving equipment and processes for all water users including technological, procedural, or programmatic improvements to the facilities and processes to decrease the amount of water withdrawn or to decrease water demand. The goal of these requirements is to assure the most efficient use of groundwater. Information on the water-saving alternatives examined and the water savings associated with the alternatives shall be provided. Also, where appropriate, the use of water-saving fixtures in new and renovated plumbing as provided in the Uniform Statewide Building Code (13VAC5-63) shall be identified in the plan;
2. A water loss reduction program, which defines the applicant's leak detection and repair program. The water loss reduction program shall include requirements for an audit of the total amount of groundwater used in the distribution system and operational processes during the first two years of the permit cycle. Implementation of a leak detection and repair program shall be required within one year of the date the permit is issued. The program shall include a schedule for inspection of equipment and piping for leaks;
3. A water use education program that contains requirements for the education of water users and training of employees controlling water consuming processes to assure that water conservation principles are well known by the users of the resource;
4. An evaluation of water reuse options and assurances that water shall be reused in all instances where reuse is practicable. Potential for expansion of the existing reuse practices or adoption of additional reuse practices shall also be included; and
5. Requirements for complying with mandatory water use reductions during water shortage emergencies declared by the local governing body or water authority in accordance with §§ 15.2-923 and 15.2-924 of the Code of Virginia. This shall include, where appropriate, ordinances prohibiting the waste of water generally and requirements providing for mandatory water use restrictions in accordance with drought response and contingency ordinances implemented to comply with 9VAC25-780-120 during water shortage emergencies. The water conservation and management plan shall also contain requirements for mandatory water use restrictions during water shortage emergencies that restricts or prohibits all nonessential uses such as lawn watering, car washing, and similar nonessential industrial and commercial uses for the duration of the water shortage emergency.

Several requirements of 9VAC 25-610-100 for agricultural users also apply to Patriots Colony with respect to water conservation for irrigation uses, even though the facility is not an agricultural user:

- Plans submitted for the use of groundwater for irrigation shall identify the specific type of irrigation system that will be utilized, the efficiency rating of the irrigation system in comparison to less efficient systems, the irrigation schedule used to minimize water demand, and the crop watering requirements. Multiple types of irrigation methods may be addressed in the plan. These requirements shall assure that the most practicable use is made of groundwater. If these options are not implemented in the plan, information on the water-saving alternatives examined and the water savings associated with the alternatives shall be provided.

Additionally, facilities with a GWWP are required to maintain a record logging the dates that activities required in the WCMP are completed. These logs are to be made available to DEQ staff upon request.

The above enumerated requirements are addressed in each subsequent of this WCMP.

1.2 Description of Beneficial Use

The Patriots Colony facility is located in James City County, Virginia and includes an approximately 90-acre campus of which approximately 16.21 acres is covered by landscaping turf. The groundwater irrigation system is used solely to irrigate turf grass currently comprised entirely of Kentucky-31 tall fescue as well as new plants and shrubs during their initial growth period after planting. The facility is connected to the James City Service Authority (JCSA) public water system, which provides all other water for human consumption by residents, employees, and contractors such as drinking, bathing, laundry, cooking, cleaning, and sanitation.

1.3 System Design and Operation

The facility's irrigation system covers approximately 15.49 acres of existing landscaping and approximately 0.72 acres to be added with the development of a new state-regulated health facility in the eastern section of the property, with both areas adding up to approximately 16.21 acres.

The irrigation system consists of separate controllers that operate the irrigation wells individually. The system is operated by timer and is programmed by season as well as by visual inspection of turf (appearance). Timers and frequency of irrigation are adjusted throughout the irrigation season, which normally runs from mid-April through mid- to late-October. The end of the irrigation season depends on when over-seeding for the next season occurs at the end of the current season.

Operation of the submersible pumps in the irrigation wells is handled by Hunter brand controllers at each wellhead. A separate electromagnetic rain gauge sends data to the pump controller and prevents the pump from activating if sufficient rainfall (one-quarter inch or more) has occurred. The volume of irrigation applied is controlled by programming the system timers. During the spring and fall, irrigation normally occurs for 10 minutes at a time and two times per week on average. During the summer, timers are adjusted to 20 minutes per event and run approximately three times per week depending on the visual appearance of the turf. Irrigation only occurs during the hours of 10pm and 8am.

Irrigation water is delivered to the turf and new shrubbery/plants via a combination of fixed and standard turf heads as well as bubblers. All heads are either Toro or Rainbird brand. Most of the delivery system is composed of rotating turf heads, with bubblers installed in the newer sections of the facility to provide water for new shrubbery and plants. Most rotating turf heads are programmed for between 25 and 180 degrees rotation, with some programmed for 360 degrees rotation. All heads are set to only water turf and occasionally new shrubbery or new plants during their initial growth period and no other areas such as pavement.

2 Water-Saving Plumbing and Processes

The facility's irrigation system utilizes several water-saving components and processes, including:

- All turf heads are rotated and programmed such that irrigation is applied only to turf and not to other areas such as pavement. This helps reduce wasting of water.
- Irrigation only occurs during the coolest hours of the day between 10pm and 8am, minimizing water loss to evaporation during warmer parts of the day.
- Operation of the submersible pumps in the irrigation wells is handled by a controller at each wellhead. A separate electromagnetic rain gauge sends data to the controller, which prevents the pump from activating if one-quarter inch or more of rainfall has occurred. This prevents turf from being unnecessarily irrigated during or after wet weather.
- The volume of irrigation applied is controlled by programming the system timers. During the spring and fall, irrigation occurs on average two days per week for as little as 10 minutes per event. During the summer, the timers are adjusted up to 20 minutes per event and irrigation occurs three times per week on average.
- For any new construction on the facility, starting with the new apartments on the east side of the campus, RHA limits irrigation areas to 30% of the pervious area within that specific construction/project area.
- The facility currently employs Kentucky-31 tall fescue for all irrigated/landscaped areas. This grass variety is drought-resistant and requires less water than some other types of turf grass.

Aside from the water conservation practices associated with the landscape irrigation system, the facility also practices conservation of JCSA-supplied public water within the facility buildings. For example, in all new buildings, installed fixtures are high-efficiency/water-conserving in accordance with the Uniform Statewide Building Code. As older plumbing fixtures are replaced in existing buildings, they are replaced with high-efficiency/water-conserving units. Much of the drinking water served in the healthcare facility is commercial bottled water shipped in from off-site. All drinking water fountains utilize motion-detection sensors to avoid wasting of water. Additionally, within the last several years, the facility converted from water-cooled condensers to air-cooled condensers on the walk-in refrigerators/coolers. For the three units converted, the cost savings was approximately \$1,500 per month, which equates to a water savings of potentially 281,000 gallons per month using a JCSA rate of \$5.33 per 1,000 gallons.

2.1 Irrigation Water Usage Reduction Study

Within the first irrigation season of the GWWP term, the facility will over-seed the existing Kentucky-31 turf grass with Bermuda grass, which has lower irrigation water demands. This over-seeding process will be repeated each year until the Bermuda grass has replaced the Kentucky-31. By incorporating an existing landscaping practice (seeding) into this water conservation measure, the facility will reduce groundwater usage for irrigation over time without creating significant disruption to the facility or its residents that would be created by other measures such as irrigation system or sod replacement. The effectiveness in water conservation achieved by converting to Bermuda grass will be documented in the Water Conservation and Management Effectiveness reports to be submitted to DEQ in years five and ten of the GWWP term.

3 Water Loss Reduction Program

Patriots Colony's water loss reduction program will focus on loss of water by routine checks for system leaks, frequent water use monitoring and control, immediately attending to system leaks, and maintaining a preventive maintenance program.

3.1 Water Use Monitoring

During the irrigation season, each well meter will be read on a weekly basis. Once baseline water usage trends have been established, the facility will compare each week's usage to normal/average ranges and will take appropriate action as detailed below to look for leaks if the usage data indicates unaccounted for water that could indicate a leak in the irrigation system.

3.2 Leak Detection Program

The facility's leak detection program for the irrigation system involves facility/maintenance staff, the landscaping contractor, security personnel, and residents. As part of an informal leak detection program, residents walk around the retirement community daily and usually notify facility/maintenance staff of leaks or wasted water (e.g., irrigation water reaching paved areas) immediately. At the beginning of each irrigation season, facility staff will conduct an annual startup inspection of the entire system to check for leaks, to adjust irrigation heads, and ensure that the system is not irrigating non-turf areas. The security team continuously patrols the entire facility every day and will incorporate leak checks into their patrols. During the irrigation season, security personnel will inspect the roadways and irrigation areas daily for evidence of leaks on the surface and report any suspected leaks to maintenance as quickly as possible, normally by first thing the following morning. Lastly, the facility's landscaping contractor mows every inch of the property on a weekly basis, allowing them to notice wet areas that could indicate a leak from the irrigation system. The landscaping contractor will also report any suspected leaks to maintenance as soon as they are discovered.

Suspected leaks discovered via water use monitoring as detailed in Section 3.1 above but which do not present visual evidence of a leak such as saturated soil or standing water on the surface will be investigated through the following steps:

1. Visual inspection by walking the entire area served by the well or wells to look for surface evidence of a leak.
2. If no surface evidence such as saturated soil or standing water is found, then the facility will check and calibrate or replace the flowmeter or meters indicating a possible leak.
3. If the meter or meters are determined to be accurate and the leak has not manifested at the surface, the facility will continue investigating by excavation. Excavation would begin at the likeliest leak points such as joints or bends in the subsurface piping.

3.3 Preventive and Corrective Maintenance

Preventive maintenance occurs primarily at the beginning and end of each irrigation season. Prior to each irrigation season, the facility/maintenance staff and the landscaping contractor conducts an annual startup inspection by walking the entire system to check for leaks. During this startup procedure, all irrigation heads are also adjusted to ensure that the system is not irrigating non-turf areas. At the end of each irrigation season, the facility blows out all of the piping and the other system components to prevent water from freezing and breaking piping and ancillary equipment.

Corrective maintenance, or repairs of leaks, will occur as soon as possible. Normally, leaks are repaired within 72 hours depending on the type, severity, and location of the leak. Readily-accessible leaks detected above-ground can usually be repaired within 24 hours if replacement parts are available. Subsurface leaks that involve excavation normally require more time to complete, typically 48 to 72 hours. The facility will deactivate or isolate any area of the irrigation system to prevent water loss until a confirmed leak is repaired.

3.4 Water Use Audit

The Patriots Colony facility will conduct an audit of the total amount of groundwater used in the irrigation system during the first two calendar years of the permit cycle. The audit will consist of the following activities:

- Review of annual and monthly groundwater usage data and comparison of this data to water demand estimates provided in the GWWP application and to GWWP monthly, annual, and 15-year limits;
- Review of leak detection and repair records; and
- Submittal of an Audit Report to DEQ.

4 Water Use Education Program

Education of groundwater users at Patriots Colony will involve facility/maintenance staff, the landscaping contractor, security personnel, and residents. Copies of this WCMP will be maintained in the maintenance office. All facility/maintenance staff, landscaping contractors, and security personnel will be required to read this WCMP. The Facilities Director will maintain documentation of training on the WCMP for these individuals.

All personnel who will be responsible for operating and maintaining the irrigation system – facility staff and landscaping contractor - will undergo an initial comprehensive training on the system and this WCMP, including requirements for leak detection and preventive maintenance. Once per year, all of these personnel will review the WCMP and demonstrate their understanding of the requirements.

All facility/maintenance staff, landscaping contractors, and security personnel will be trained to check and identify system leaks and to report any suspected or confirmed leaks to the on-duty maintenance manager immediately.

To educate residents as part of the leak detection program, the facility will post signs along the irrigated areas asking residents to report leaks or problems with the irrigation system such as overwatering or water reaching paved/non-turf areas. Additionally, the facility will distribute educational materials to residents of the retirement community, which will consist of a new section on the facility's website and a new section on the weekly Patriots Colony newsletter (the "Colony Crier").

The Facilities Director will hold an annual meeting before the beginning of the irrigation season to review the WCMP. Meeting attendees will include facilities/maintenance staff, the landscaping contractor, and security personnel. The annual meeting will provide an educational opportunity for all individuals responsible for operation of the irrigation system and those with leak monitoring responsibilities. During or following this annual meeting, the facility may revise the WCMP. Any revisions to the WCMP will be submitted to DEQ for review and approval prior to implementation.

5 Water Reuse

Currently, there are no viable opportunities for water reuse at Patriots Colony. Groundwater is used solely for irrigation of landscaping turf and some new plants and shrubbery during their initial growth periods. Therefore, the vast majority of the water is transpired by the grass and incorporated into its plant matter as it grows. The irrigation system is designed to provide the optimum amount of water to the soil for the grass to grow, and is designed to eliminate or prevent runoff. Runoff generated by the system is an indication of overwatering, incorrect irrigation head setting, or a leak, all of which would be corrected immediately. Therefore, runoff generated by the system is not available for reuse.

Most wastewater generated at the facility discharges to the Hampton Roads Sanitation District (HRSD) sanitary sewer. Use of this type of municipal wastewater for irrigation without significant treatment could present health hazards to the facility residents, staff, contractors, and visitors. Therefore, this is not a viable reuse option for landscaping irrigation water.

Another type or potential alternate source of water for the irrigation system that could be considered water reuse is stormwater, which would need to be captured and stored in retention basins ("wet ponds"). With the exception of one wet pond located behind the bistro, all existing stormwater ponds are detention basins ("dry ponds") that hold water for brief periods of time insufficient to be stored for irrigation use when needed. These dry ponds only hold water during and immediately after rainfall events, when irrigation water is not needed. During dry periods when irrigation of the turf is needed, these dry ponds do not have water in them. With regard to the Patriots Colony apartment project, which consists of approximately 6.3 acres of disturbance, the wet pond/bioretention basin only receives approximately 2 acres of drainage. The Virginia Department of Conservation and Recreation (DCR) Stormwater Design Specification #14 for Wet Ponds (version 2.0, January 2013) states that: *"A contributing area of 10 to 25 acres or more is typically recommended for wet ponds to maintain a healthy permanent pool. Wet ponds can still function with drainage areas less than 10 acres, but designers should be aware that these 'pocket' ponds will be prone to clogging and experience extreme fluctuations in seasonal water levels and be susceptible to creating nuisance conditions."* Therefore, this sole wet pond/bioretention basin behind the bistro does not have sufficient acreage to create enough water storage for use in turf irrigation. Similar to the dry ponds elsewhere on the facility, the wet pond has more water during and after rainfall events when the turf does not need irrigation and has less water during dry periods when the turf does need irrigation. Finally, creation of additional, new wet ponds on the facility is prohibited by the current development of the facility and buffer requirements (e.g., proffers), such that additional construction on the facility after completion of the new apartment complex is not possible.

The potential alternative source of collecting rainwater from the roofs within the approximately 90-acre campus is viewed as prohibitive, given the number of buildings, how distributed the buildings are over the entire facility, and the complexity of the rainwater storage and conveyance system that would be needed to tie such a system into the existing irrigation piping network. There are approximately 90 acres over the entire facility, of which only 16.21 acres are covered by the irrigation system. Over 240 buildings are on the property, counting single family units, 68 villas and 150 apartments. The roof area of these buildings equals 11.7 acres. Additionally, large holding vessels would have to be installed near the irrigation system to store captured rooftop rainwater when it is generated during precipitation events when landscaping doesn't need irrigation. Later, the water would have to be pumped from the storage vessels during dry periods when precipitation is not available to the turf and plants. Therefore, with so many rooftops spread out over a 90-acre facility, installing a roof-top rainwater collection system would be complex and is considered cost prohibitive.

The facility will continue to explore potential water reuse options in the future if operations change.

6 Requirements for Mandatory Water Use Restrictions

The *Hampton Roads Regional Water Supply Plan* (2011) provides procedures and guidelines for managing water use during water shortages. Similarly, James City County has a Water Conservation and Drought Management Plan (amended October 2002) that sets the County and JCSA policy for water use restrictions under County Ordinance Chapter 11, Article VI (Drought Management). These use restrictions are short-term compared to the normal full-time water conservation programs outlined in this WCMP, and are only implemented during periods of drought when adequate water supply may be threatened. It should be noted that self-supplied users that rely on deep wells such as Patriots Colony are relatively buffered from the effects of drought as the source aquifers are recharged by the lateral movement of groundwater within the confined aquifers. The U.S. Geological Survey (USGS) has demonstrated that water in the deep confined aquifers such as the Potomac was recharged hundreds to millions of years ago.

Patriots Colony will comply with any applicable mandatory water use restrictions during water shortage emergencies declared by James City County, JCSA, or the Commonwealth of Virginia that prohibit all non-essential water uses for the duration of the water shortage emergency. The facility's GWWP is solely for the irrigation of landscaping turf and does not include any other uses that would be considered non-essential (e.g., vehicle washing), however. The irrigation system will be operated in accordance with this WCMP, which minimizes the wasting of water. Maintenance of turf grass for landscaping is a non-essential water use. Therefore, Patriots Colony will follow all local, regional, and state prohibitions of non-essential water use during water shortage emergencies, including reduction of water usage for irrigation or complete or cessation water usage for irrigation.

7 WCMP Effectiveness Reporting

By the end of years five and ten of the GWWP term, Patriots Colony shall develop a report on the effectiveness of this WCMP in minimizing water use. This will include revisions to those elements of the WCMP that can be improved and addition of other elements found to be effective based on operations to date. These reports shall include:

- Any new water-saving equipment installed or water-saving processes adopted.
- WCMP actions taken to reduce the volume of water needed to supply the system.
- Planned short or long-term efforts and actions to be added to the WCMP to improve the efficiency of water use in the system and for reducing the loss of water.
- Results of additional water audits completed.
- Evaluation of the leak detection and repair program.
- Description of educational activities completed.
- Identification of any water reuse opportunities identified.